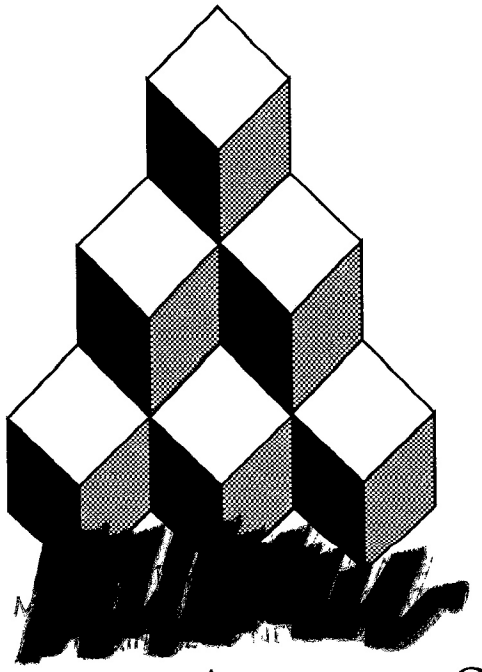
Ventura Educational Systems

Tools for Active Teaching and Active Learning



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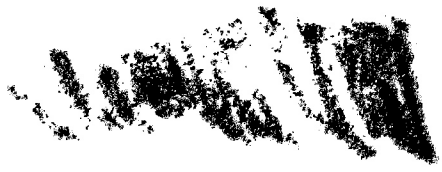

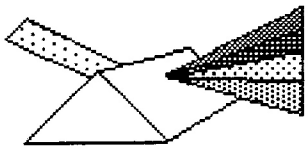

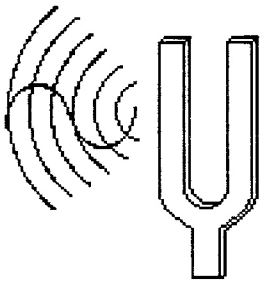

All About Light and Sound

Elementary Science Software
Grades 4-8

Ventura Educational Systems
910 Ramona Avenue Suite E
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Credits

Software Design — **Ventura Educational Systems**

Instructional Technology and Programming — **Fred Ventura, Ph.D.**

Editor — **Marne Ventura, M.A.**

Dr. Fred Ventura is an experienced classroom teacher and has taught elementary, secondary and college levels. He holds a doctorate in education from the University of California, and presents workshops for educators on the instructional uses of microcomputers.

Marne Ventura is also an experienced classroom teacher and holds a masters degree in reading and language development from the University of California. As a seminar leader, Marne Ventura has assisted many teachers in learning about the educational opportunities that can be derived from the use of microcomputers in the classroom.

Ventura Educational Systems publications include:

Math Grades 7 - 12
Algebra Concepts
Coordinate Geometry
Geometry Concepts
SuperGraph

Science Grades 7 - 12
Anatomy of a Fish
Anatomy of a Shark
Chemaid
The Earthworm
The Fetal Pig
The Insect World
Life Cycle of a Sea Lamprey
Marine Invertebrates
Plant and Animal Cells
The Plant
Protozoa
Senses
VisiFrog

Teacher Utilities
Clip-Art for Math Teachers
Clip-Art for Science Teachers
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Math Grades K - 8
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Hands-On Math Series
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Balancing Act
Probability Toolkit

Math Grades 4 - 8
Beginning Geometry
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Science Grades 4 - 8
All About Matter
All About the Solar System
All About Light & Sound
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Computer Literacy Grades 7 - 12
Computer Concepts
Dr. Know

Other Subjects Areas Grades 4 - 8
Music Concepts
Plexers/More Plexers
States

Educational Kits Grades 7 - 12
Hands-On Electronics

Integrated Curriculum Materials
Portraits of Famous People Series

Additional Program Disks
Many schools have more than one computer and to effectively use educational software require additional legal copies of a program. Additional program disks are available for use in a computer lab. Please contact Ventura Educational Systems for further information. There is a 30 day warranty on original program disks. If for any reason a program disk becomes defective within 30 days of the date of purchase, Ventura Educational Systems will replace it at no charge.

Conceptual Framework for All About Light and Sound

Eons ago, when the earth had cooled sufficiently to sustain organic life, the sun was radiating enormous masses of energy, some of which fell upon the earth. In the primordial sea, the very earliest forms of life were bathed in sunlight. From that earliest time and throughout all of evolution the sun has been an important environmental factor.

The sun is a minor star in the great cosmos and yet the significance of the energy it radiates is hard to imagine. Take a minute to think about all the coal, gas, and nuclear energy consumed by all the factories and machines used by all the people of the world during a one month period. Our planet's star, the one that we call the sun, radiates more energy in a couple of minutes. The sun produces an enormous amount of radiant energy. This energy is available to us and as technology progresses it will be possible to transform the enormous energy of the sun into clean, useful forms that will replace our existing reliance on other types of fuel that are diminishing and polluting.

For centuries it has been known that sunlight is a powerful source of energy. While the exact nature of light energy is still not fully understood, for hundreds of years people have been able to harness the energy of sunlight and put it to practical use. For example, the use of a lens to focus a beam of sunlight, and generate enough energy to cause wood to catch fire has been used for many centuries. One tale from the ancient Greeks tells of a clever Archimedes who defended Syracuse by devastating a fleet of Spartan ships using mirrors to focus sunlight on the sails of the ships which caused them to catch on fire. Even though the Greeks were able to effectively use light energy, their understanding of it was incorrect. Plato believed that vision occurred because the eye sent out some kind of a pulsing stream of particles that were bounced back to the eye by objects in the environment.

In the strictest and ultimate sense, light is a sensation that is aroused by radiant energy at certain wavelengths and frequencies. In the 17th and 18th Centuries astronomers were astounded when they found evidence of the incredible power of light. It was observed that the tails of comets appeared to be curved as if they were being blown by a mysterious kind of wind. The astronomers explained the effect as being caused by some type of light pressure. In futile attempts to reproduce what had been observed in space in the controlled environment of the laboratory, these scientists suspended delicate pieces of paper in the beams from high-powered light sources but were unable to get even the slightest movement. Even so their idea was not incorrect. In the early 1900's scientists with very sensitive equipment were able to detect the presence of light pressure.

The human eye, an amazing apparatus, is extremely sensitive to certain wavelengths of radiant energy. At the extremes of the visible spectrum are

magnetic wave traveled at the same speed as light, and concluded that light itself was a form of what he termed "electromagnetic radiation".

In 1888, Heinrich Hertz, a German physicist, observed that when a spark jumped between two terminals, a smaller spark could be recorded on terminals on the other side of the room. A practical application, derived from Maxwell's and Hertz's discoveries, was given to the world by an Italian inventor named Guglielmo Marconi. Marconi developed and patented a radio transmitter and receiver in 1896 by extending the underlying principles of Hertz's work. Marconi's invention used electromagnetic radiation with wavelengths that are longer than the wavelengths of visible light.

At about the same time that Maxwell and Hertz were making their discoveries, Wilhelm Konrad Roentgen discovered another form of radiation that has a wavelength that is shorter than visible light. Roentgen named the type of radiation that he discovered X-rays. It was almost by accident that Roentgen made his discovery. He was working as a professor of physics at the University of Wurzburg in Germany, studying the effects of passing an electrical current in a vacuum from one terminal to another inside a cathode tube. When Roentgen darkened the laboratory to better observe the glow from the cathode tube he noticed that a piece of glass covered with barium salts near the device also glowed when the tube was operating even though the glass was separated from the cathode tube by a black paper screen. Intrigued by what he was observing, Roentgen continued to experiment with this strange 'light'. He found that the rays from the cathode tube seemed to penetrate everything; wood, aluminum, even his hand. He discovered that when the rays passed through his hand and struck a photographic plate, an amazing image of the bones in his hand resulted.

Stimulated by the discoveries of Roentgen, Henri Becquerel set up an experiment using a sample of uranium placed on top of a photographic plate wrapped in black paper. He planned to take the sample out into bright sunlight which he knew would cause the uranium sample to glow, but the day was cloudy so he put the sample in a drawer with the ore still on top of it. When he later developed one of the plates that had not been exposed to sunlight he discovered that the image of the ore was the same as if it had been placed in direct sunlight. From this he concluded that uranium gives off radiation. In 1897, Marie and Pierre Curie found two new elements that have the same property as uranium. Through analysis of the radiation the Curies discovered that it was made up of three types of waves which were named alpha, beta and gamma. Alpha and beta rays result from electrically charged bits but gamma rays are something different. Gamma radiation results from the decay of natural radioactive substances. (Also from artificial ones such as nuclear reactors and atomic bombs.)

other hand if an electron drops from an outer orbit to an inner orbit energy is released. The energy that is released is given off in the form of a photon. Electrons' changing of energy levels is the basic mechanism by which light is absorbed and produced.

All About Light and Sound is a first step in the exploration of the nature and characteristics of light. The topics are presented on an introductory level and are designed to stimulate further interest and supplement other educational approaches. Activities and experiments are suggested in this manual which add to the excitement of studying the visible portion of an electromagnetic spectrum.

Content, Process and Attitude

The All About Light and Sound learning system focuses the student's attention on the nature of light and sound. Emphasis is placed on learning basic concepts in the theory used to explain the nature of light and sound, and the terminology associated with characteristic behaviors of light waves and sound waves. A part of the learning system is devoted to helping students develop an understanding of how the eye and ear function as sensory receptors of light and sound.

The classroom science teacher who uses the All About Light and Sound learning system will find that it is an interactive educational environment that provides students with the opportunity to explore many introductory topics related to the study of electromagnetic radiation, waves and sense organs. As an information resource, the All About Light and Sound learning system enables students to access information which is presented in a variety of formats. The ease of use of the menu system utilized in this program makes it possible for students with little computer experience to operate the program.

The lessons are the tutorial components of the program and allow the student to proceed through a series of sentences about the selected topic in a self-paced manner. The probe allows the student to quickly access more detailed information about graphically represented diagrams of concepts related to light and sound and also of the sense organs. Learning games motivate students to master the science terminology used in the program and a quiz for each topic measures the student's progress.

Students who use the All About Light and Sound learning system will develop a positive attitude toward the study of physics because the system involves the student in the learning process by presenting options at a variety of points in the program. The menu driven format of this instructional product allows the student to explore light and sound in his or her own way. All options lead to interesting and rewarding activities.

Scientific Concepts

Through the use of the All About Light and Sound learning system, students become more interested in the study of physics. It is important for students to learn about light and sound because this information is basic to having a scientific understanding of the world. This knowledge is part of the basic information that can be important in adult life. If the student's course of study will lead him or her to a more in-depth study of physics, the knowledge gained from this learning system will be beneficial as a base for more specific information.

To develop a solid understanding of scientific concepts and true science literacy, an individual must be able to make observations, formulate theories and test hypotheses. This process is very difficult, perhaps impossible, without a knowledge base from which to draw. The All About Light and Sound learning system is designed to provide students with an opportunity to explore information about matter in an interactive, self-directed manner and to develop a deeper interest in science. These materials are particularly useful when used in conjunction with laboratory explorations.

Instructions for MS-DOS version:

System Requirements for IBM, Tandy 1000 or Compatibles

The computer system described below is the minimum hardware configuration required to use this program.

IBM pc, Tandy 1000 or Compatible
Video Monitor (CGA required)
Single Disk Drive or Hard Disk
DOS 2.1 or higher

Programming Language: QuickBasic

A note for users with a hard disk:

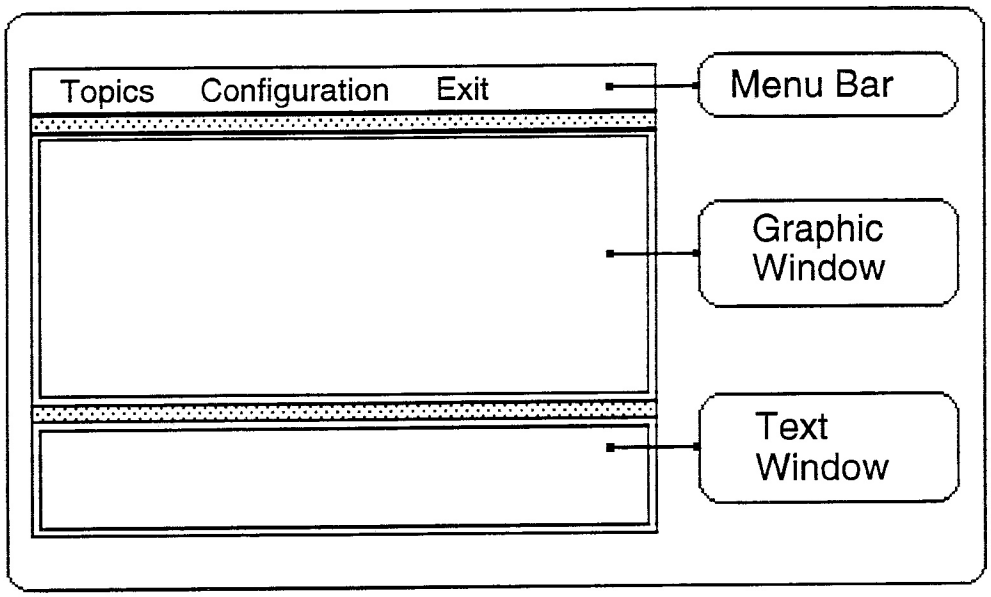
If the program is to be used on a hard disk system all the files on the distribution diskette should be copied into a directory on the hard disk. To install All About Light and Sound on a hard disk follow this procedure:

1. After the system has been booted put the All About Light and Sound disk in drive A:. At the C:> prompt type A: and press enter.

2. Type INSTALL.

screen is used for presenting graphic information and the bottom section of the screen is primarily used for text.

Sample Screen:



Menu Control Keys

Use the right and left arrow keys to move the highlight indicator from one choice to another. Press the return key to select a choice. The escape key [ESC] may be used to cancel a choice and return to the previous menu.

[Arrows]	**moves the indicator right or left**
[Return]	**selects the highlighted option**
[Escape]	**cancels a choice and returns to a previous menu**

Light The Light option reveals a diagram in which several images are used to represent terms pertaining to the behavior of light (reflection, refraction and diffusion) and terms pertaining to the properties of material related to light (transparent, translucent and opaque). The lesson and activities associated with this instructional path deal with the observable behavior of light and sound and the properties of materials related to light and sound.

Sound The Sound option leads to a diagram showing some examples of the fact that the rate of transmission for sound is different in different types of media and that the loudness of sound is measured in decibels. The lesson and associated activities for this path introduce students to the idea that the speed at which sound is transmitted is affected by the media and that sound has qualities that can be measured.

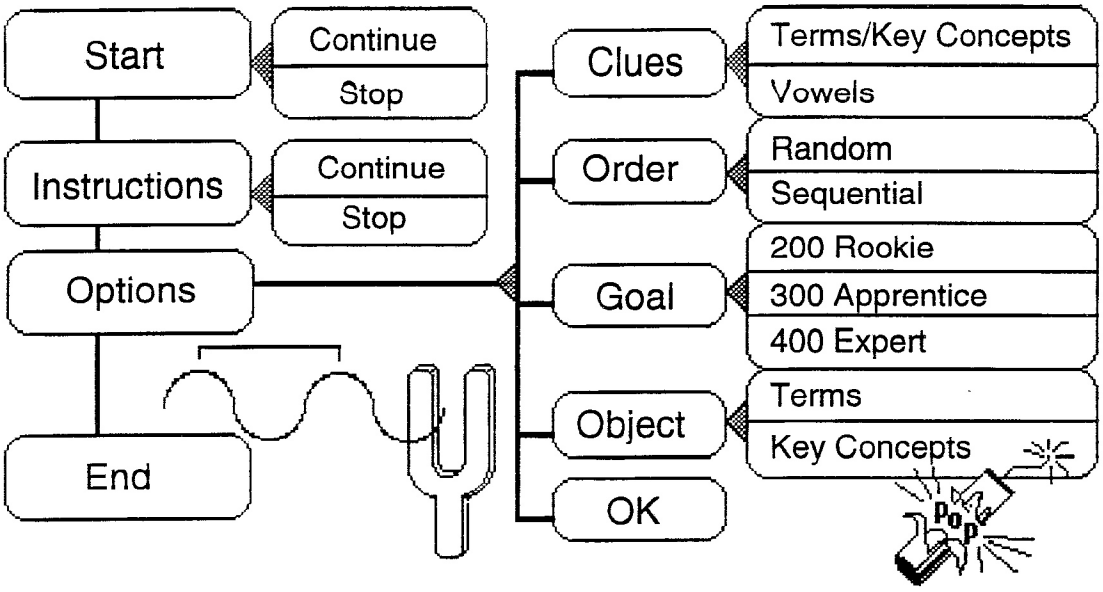
Senses Choosing the Senses option from the menu causes a diagram of the eye and the ear to be shown. In the lesson and associated activities students learn about the parts of these senses organs and how the parts function in the process of perceiving light and sound.

Activity Menu

After making a selection from the Topic Menu the program proceeds to the Activity Menu where either a lesson, probe, game or quiz can be selected.

Lesson The lesson is a self-paced learning activity where information is presented in the text window and the diagram is displayed in the graphics window. The options presented in the menu bar are Next or Previous. Choosing Next advances the lesson to the next screen. Previous allows the user to back up to previous sentences in the lesson. At the end of the lesson the options: Review or Main are given. Select Review to do the lesson again or select Main to return to the first menu.

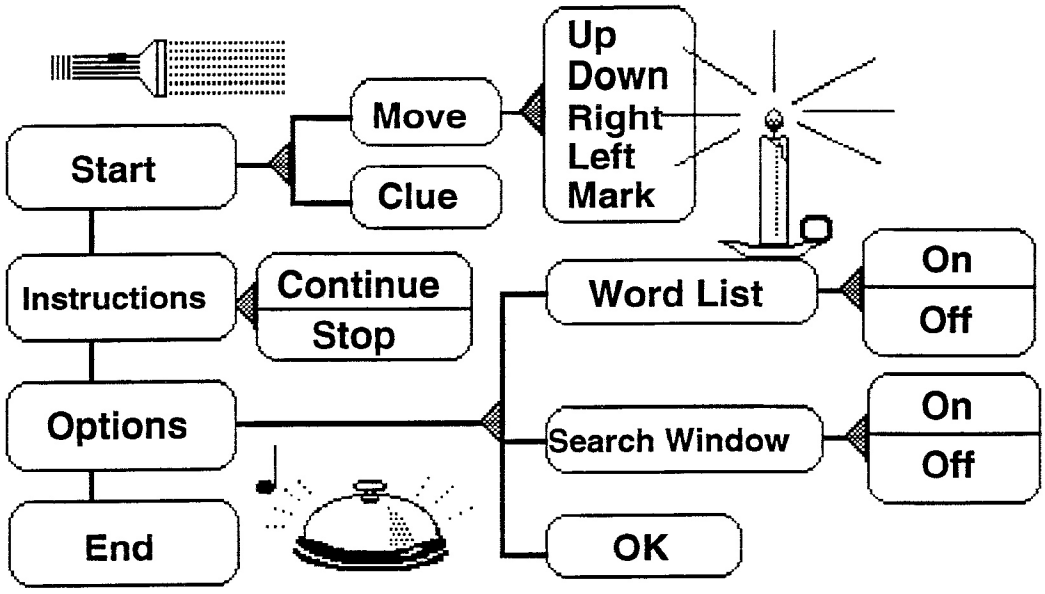
Probe The Probe is an activity where detailed information on the term associated with a concept illustrated in the diagram can be quickly accessed. The program allows the user to move forward or backward through a list of terms. The Description option gives more complete information about the term and associated concept.



Use of this game is particularly effective after the student has spent some time working through the lessons and probe activities. When finished with this activity select End to return to the main menu.

Scrambler

Scrambler, as the name suggests, scrambles the letters in a term. The object of this game is to unscramble letters as quickly as possible to spell a science term, when given a definition of the term. The first menu in the game gives the options: Start, Instructions, Options, End.



Novice users of this game may wish to set the Word List and Search Window options to On. The Word List option determines whether or not the list of words hidden in the puzzle is to be shown on the screen while solving the puzzle. The Search Window shows the group of letters that has been indicated when the computer checks them.

After selecting Start, the computer will 'think' for a minute and create a unique puzzle using a random set of words from the file of words pertaining to the topic view that has been selected at the View Menu. When the puzzle has been created the letters in the puzzle will be shown on the grid. At this point the options Move and Clue will be shown. Select Clue to see one of the words in the puzzle or select move if a word has been located in the puzzle. Select Up, Down, Right, Left to move the indicator to the first letter of the word and then select Mark. Move the indicator to the last letter of the word and select Mark again. The computer will check the letters along the line between the two marks. If the letters make a word that is in the set of terms, that word is removed from the list. Play continues until all words in the list have been located in the puzzle.

If the search window is 'on' the computer will display the set of words in forward and backward order, illustrating that words can be marked either from first letter to last or from last to first.

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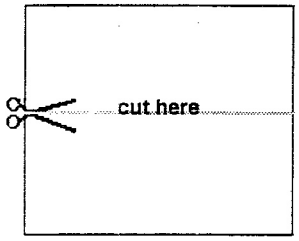
Name _____ Date _____

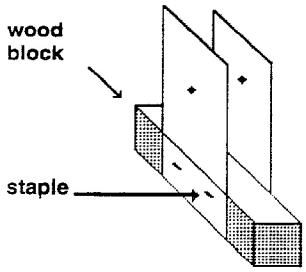
Activity #2 — Observing Light

In this experiment try to see a flame by looking through two tiny holes.

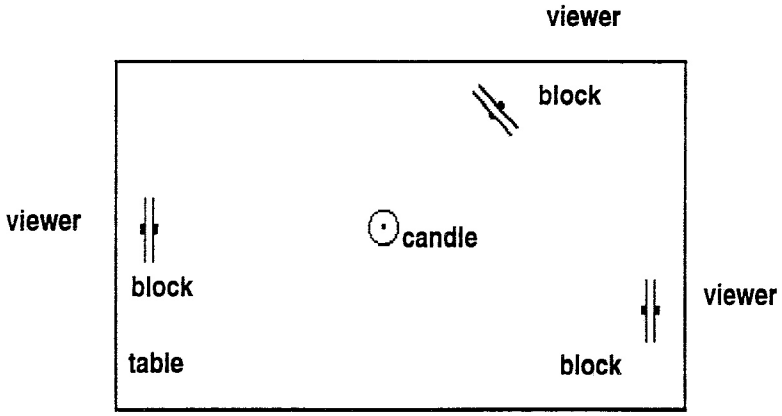
Materials:

3 small blocks of wood
small candle
scissors
1 piece of black construction paper (8 1/2" x 11")
stapler
matches
hole punch





Fold and cut the paper into 6 equal parts. Punch a hole in the center of each piece of black paper and mount two pieces to each block as shown. Place the candle in the center of a table and light it. Stand the wooden blocks near the edges. Adjust the blocks so that the flame can be seen through the two holes.

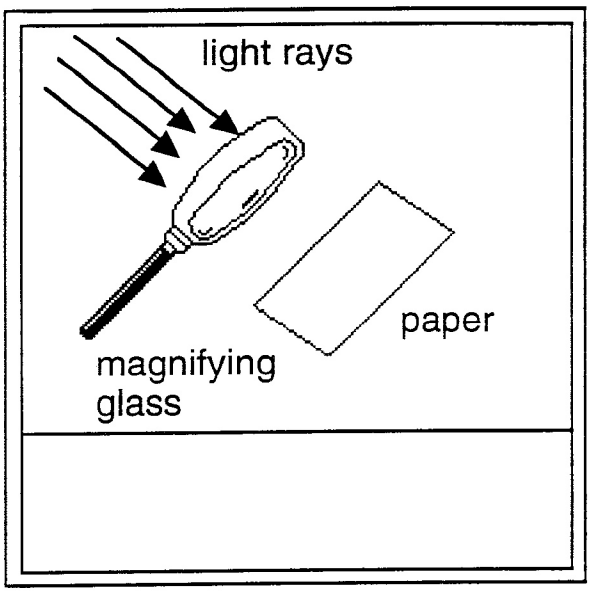


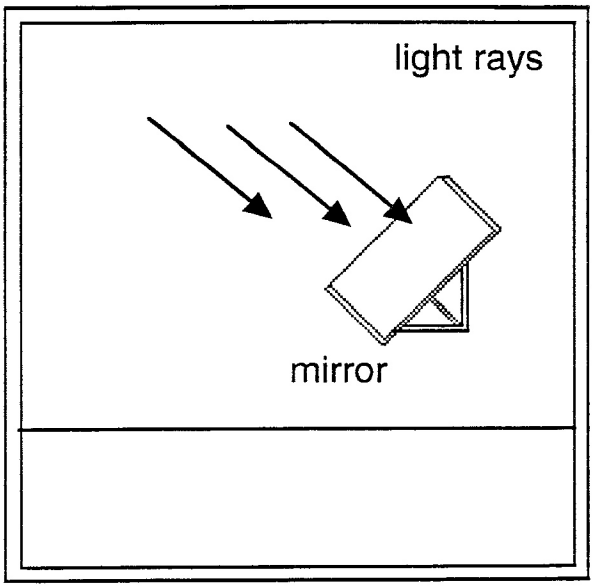
Explain why the flame can be seen through the two holes only when the block is in a certain position.

Name _____ Date _____

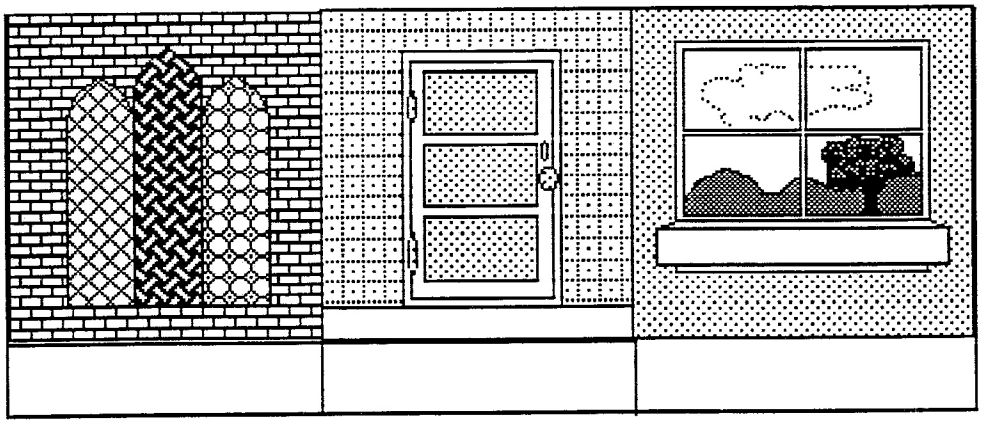
Activity #4 — Characteristics of Light

When light strikes an object several different things can happen. The diagrams below are examples of some of the things that can happen to light rays when they strike an object. In each diagram show the path of the light rays and write a word to describe what happens to the light.





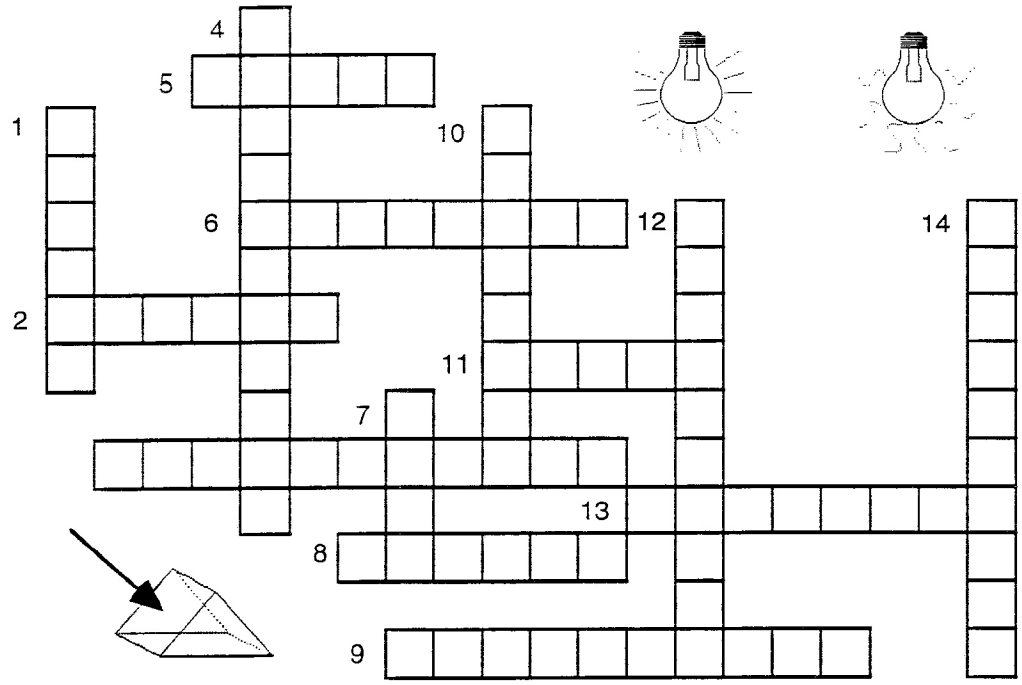
Transparent materials allow light to pass through and objects on the opposite side can be clearly seen. Translucent materials allow light to pass through but objects are not clearly visible. Opaque materials do not allow light to pass through at all. Use the words transparent, translucent, and opaque to describe the materials illustrated below.



Name _____ Date _____

Activity #6 — Crossword Puzzle #1

Complete this puzzle to review the information on light and sound.



Across

2. A word that describes material which does not allow light to pass through.
3. A word that describes material which allows light to pass through and objects on the opposite side can be seen clearly.
5. A device with a triangle-shaped base and straight sides that can be used to demonstrate that white light is made up of a variety of colors.
6. A band of colors showing all the wavelengths of visible light.
8. The speed of light is 186,000 miles per _____.
9. A unit of measure that describes the distance from the crest of one wave to the crest of the next.
11. A hue.
13. Light rays travel in _____ lines.

Down

1. A common object used to reflect light rays.
4. A word that describes material which allows light to pass through but objects which are on the opposite side cannot be seen clearly.
7. A theory that describes light as energy in a repeating series of crests and troughs.
10. A theory that describes light as tiny packets of energy.
12. The bending of light rays.
14. The bouncing of light rays.

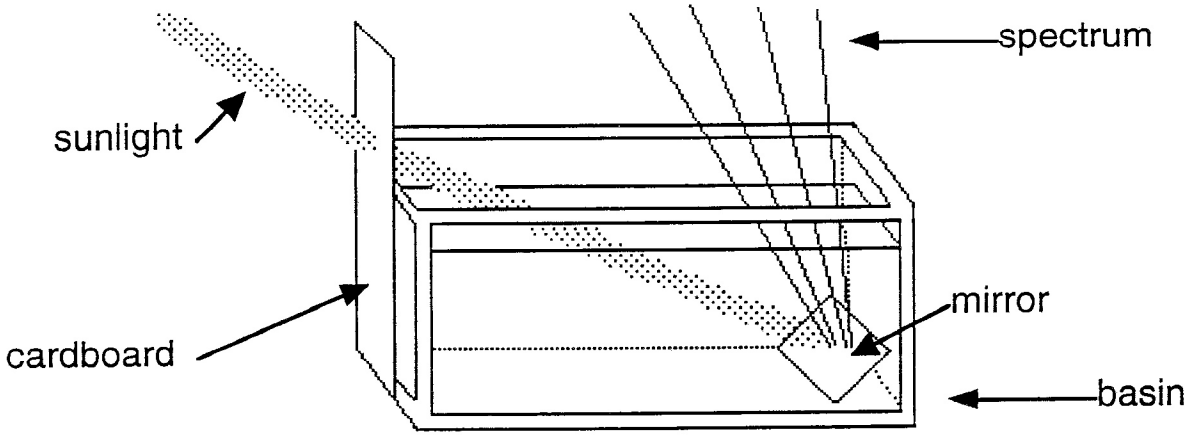
Name _____ Date _____

Activity #8 **Making a Spectacular Spectrum**

A spectacular display of dancing colors can be created by splitting sunlight into a band of colors called a spectrum. A triangular prism can be used to create a spectrum but in this experiment you will use just water and a mirror.

Materials:
a large, shallow basin
small mirror
large sheet of cardboard

Procedure:
1. Cut a small hole in the cardboard.
2. Fill the basin with water and position the small mirror in the water at a slight angle.
3. Arrange the cardboard, basin, and mirror so that sunlight will pass through the slit in the cardboard, strike the mirror and be reflected onto the ceiling.



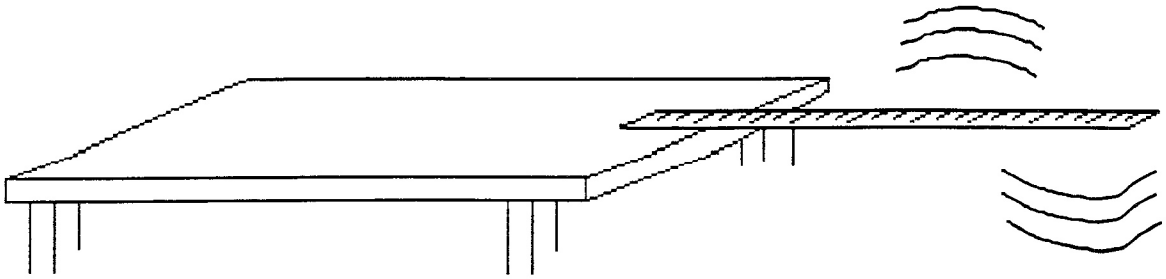
Write the names of all the colors that you see in the space below:

Name _____ Date _____

Activity #9 (Continued) **Estimating Decibels**

Decibels	Examples
0	
11-20	
21-30	
41-50	
51-60	
61-70	
71-80	
81-90	
91-100	
101-110	
120	

Name _____ **Date** _____



What conclusion can you draw about the length of ruler that is extended past the edge of the table and the sound that is produced?

Answers to Activity Pages

Activity #1 — Introduction to Light

Answers will vary. A possible answer:

Observation 1: Light from the hole in the coffee can lid makes a straight line upward from the coffee can. The chalk dust in the light helps make the light visible.

Observation 2: Light from several holes in the coffee can lid makes several lines of light upward from the coffee can. The chalk dust in the light helps make the light visible.

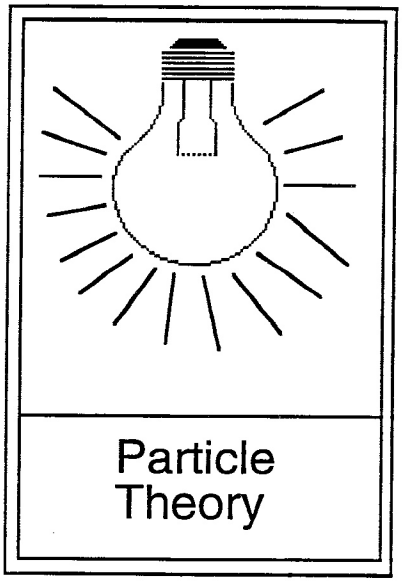
Conclusion: This experiment shows that light travels in a straight line.

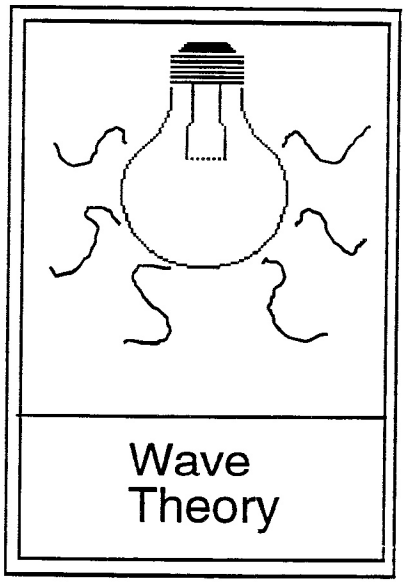
Activity #2 — Observing Light

Explanation: Answers will vary. A possible answer:

The flame from the candle can be seen through the two holes only when the holes line up along the line where the light is traveling.

Activity #3 — Theory of Light

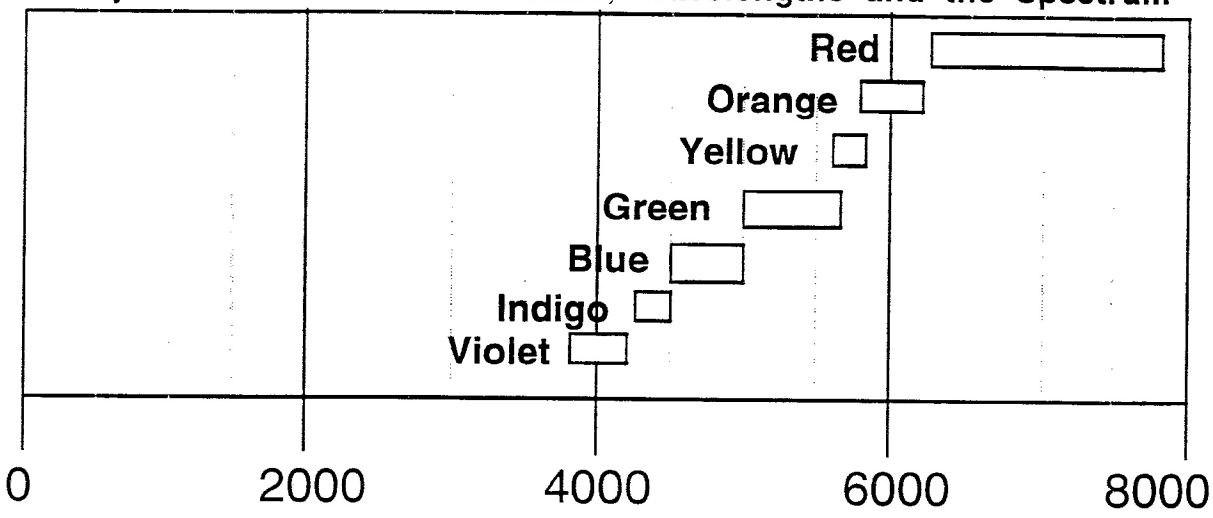


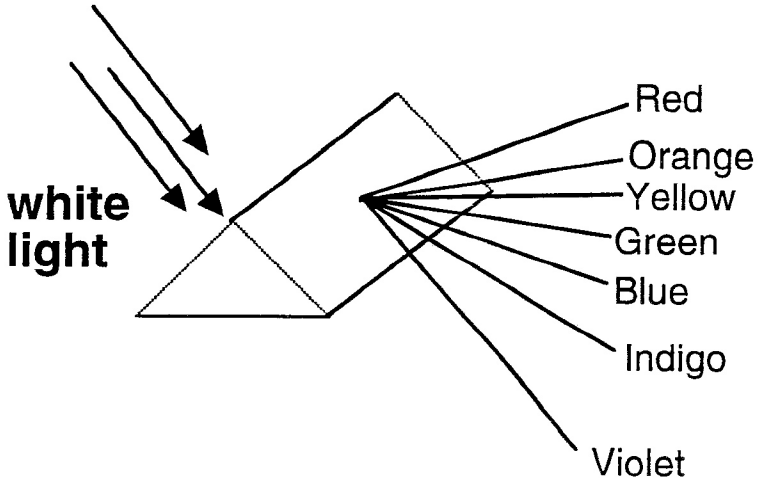


1. The speed of light is 186,000 miles per second.
2. The particle theory describes light as tiny particles that radiate out from a light source.

Activity #5

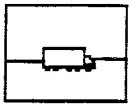
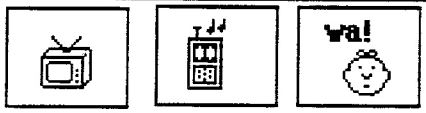
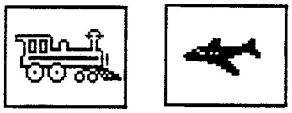
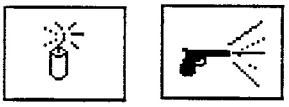
Color, Wavelengths and the Spectrum





Activity #9 **Estimating Decibels**

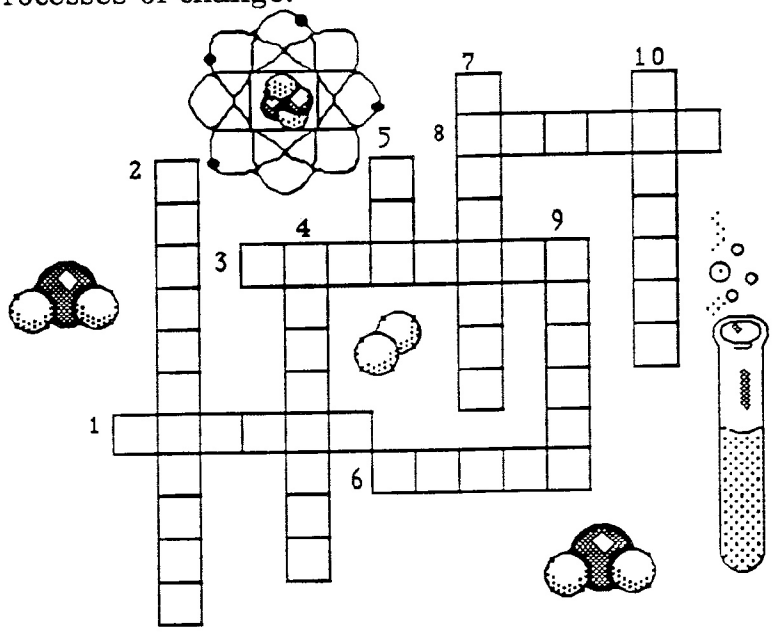
Answers will vary. Possible answers:

Decibels	Examples
0	
11-20	
21-40	
41-50	
51-60	
61-70	
71-80	
81-90	
91-100	
101-110	
120	

Name_____ Date _____

Activity #11 **Review Crossword Puzzle 2**

Complete this puzzle to review the information presented on states of matter and processes of change.



Across

1. The ability of liquids to move upward is called capillary _____.
3. Matter can be described and identified by _____ and chemical properties.
6. A state of matter in which the substance holds its form.
8. An element usually found as a gas in the air.

Down

2. When the molecules in a substance move closer together it is called _____.
4. _____ and oxygen make up the water molecule.
5. A state of matter in which the molecules move very quickly and the substance has no form and will expand to fill any container.
7. Two or more atoms joined together.
9. A state of matter where the molecules attract each other.
10. The attraction of molecules in a liquid create what is called surface _____.

